(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 August 2002 (29.08.2002)

PCT

(10) International Publication Number
WO 02/065848 A1

(51) International Patent Classification[7]: A23J 1/02, 3/34, A23K 1/10, 1/16, 1/18

(21) International Application Number: PCT/GB02/00685

(22) International Filing Date: 18 February 2002 (18.02.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0103879.3 16 February 2001 (16.02.2001) GB

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/065848 A1

(54) Title: FOODSTUFF

(57) Abstract: A method of providing a concentrated animal protein product for use as a protein source in foodstuffs comprises hydrolysing the animal protein to form a slurry and removing water from the slurry and optionally removing fat from the concentrated animal protein product prior to inclusion of the product in a foodstuff. The hydrolysis can be enzymatic hydrolysis or autolysis.

FOODSTUFF

This invention relates to a concentrated animal protein, such as meat protein, product suitable for use as a protein source in foodstuffs, such as pet foods.

It is nutritionally desirable in the manufacture of processed foodstuffs, including pet foods, to incorporate protein into the food product. It is known to incorporate protein into foodstuffs from a number of sources, including animal protein sources, principally muscle meat, including fish, viscera and connective tissue, but also other animal proteinaceous material such as feathers.

Pet foods are commonly divided into three categories according to their moisture content; pet foods containing less than about 12% water by weight are generally termed "dry", those containing between about 12% to about 35% water by weight are generally termed "semi-moist" and those containing between about 35% to about 85% water by weight are generally termed "wet". Raw meat contains between about 65% to about 75% water and between about 10% and about 20% protein by weight. The high water content of raw meat limits the quantity which can be incorporated into pet foods whilst maintaining an acceptable overall water content for the product. Conventionally, in order to incorporate higher levels of animal protein into pet foods and other foodstuffs, meat meals are employed as a protein source. Meat meals commonly contain between about 3% to about 9% water and between about 55% and about 75% protein by weight. The lower water content of meat meals compared to raw meat enables greater quantities of protein to be incorporated into the pet food by inclusion of meat meals without increasing the water content of the pet food beyond an acceptable level. Conventionally, meat meals are produced

by rendering raw meat (heating in superheated steam to temperatures of between about 105°C and about 140°C), then pressing the rendered material to squeeze out water and fat. The dried and defatted product is then ground to form a powder which may be incorporated into a foodstuff.

The severe conditions employed in the rendering process used to produce meat meals result in the meat protein in the meals being denatured to an extent during rendering, making the protein less available for digestion by the animal consuming the foodstuff into which the meal is incorporated. The high temperatures used during rendering result in the loss or degradation of heat labile and/or volatile components from the meat, such as vitamins. In addition, water soluble nutrients, such as vitamin C, and fat soluble nutrients, such as vitamins A, D and E, are lost from the meat in the water and fat which is pressed out after rendering. In order to achieve an acceptable nutritional profile for the final product, it is often desirable to reintroduce a number of the nutritional components lost from the meat during manufacture of the meat meal to the foodstuff through the addition of supplements, which increases production costs. As well as being nutritionally undesirable, the loss or degradation of heat labile and/or volatile components from the meat during rendering, and the loss of water and fat soluble nutrients from the meat when pressed after rendering, can result in significant variations in the nutritional profiles of the meat meals produced. As previously discussed, raw meat is also defatted during rendering. Consequently, to improve both the palatability and nutritional profile of foodstuffs incorporating meat meals it may also be desirable to reintroduce fat, commonly through the addition of poultry fat, beef tallow or vegetable oil, such as sunflower oil or soya oil, which again leads to increased production costs. The apparatus employed to produce meat meal imposes limitations on the mix of starting materials which may be

utilised to produce meat meals; a minimum proportion of hard and/or fibrous animal material, such as bone, must be included in the mix in order to enable water and fat to be pressed out of the meat after rendering.

It is desirable to be able to tailor the nutritional profile of a foodstuff predictably and reliably through variation of the starting ingredients. The apparatus-imposed restriction on the mix of starting materials which may be employed to produce meat meals, together with the inconsistencies introduced into the nutritional profiles of meat meals by the losses of heat labile and/or volatile components and water and fat soluble nutrients from the meat during production of meat meals, impair this ability.

According to the present invention there is provided a method of providing a concentrated animal protein product for use as a protein source in foodstuffs, comprising hydrolysing the animal protein to form a slurry and removing water from the slurry. The animal protein is preferably meat but may be other proteinaceous animal material. The concentrated animal protein product can be made from a wide range of mixes of starting materials, including mixes of starting materials unsuitable for the manufacture of conventional meat meals. The invention also encompasses the concentrated animal protein product provided by the method.

Also according to the invention there is provided a foodstuff, such as a pet food, incorporating a concentrated animal protein product according to the invention.

Also according to the invention there is provided a method of controlling the nutritional content of a foodstuff comprising: selecting a desired level of each of a plurality of components of the food stuff; providing a concentrated animal protein product by a method of the invention having levels of the said components such that when the said

product is incorporated in the foodstuff the said components are in the foodstuff at the desired level of each component in the foodstuff; and incorporating the said product in the foodstuff.

The concentrated animal protein product of the invention enables the production of foodstuffs with high animal protein content, adequate fat levels and improved nutritional performance, in terms of nutritional profile and digestibility/bioavailability, compared with foodstuffs relying on conventional meat meals as a protein source. By selection of appropriate animal protein starting materials, the need for the addition of vitamin, fat, oil or other nutritional supplements in order to produce satisfactory foodstuffs can be reduced or eliminated. Additionally, the concentrated animal protein product of the invention enables manufacture of foodstuffs with predictable and reliable targeted nutritional delivery through the selection of animal protein starting materials.

Preferably, the animal protein is raw meat, which may be fish, preferably pre-ground.

Preferably, the hydrolysis of the animal protein is enzymatic hydrolysis, more preferably autolysis, but may also be acid or alkali hydrolysis.

Known water removal techniques may be employed to concentrate the meat slurry, such as osmosis, forced circulation evaporation, ultrafiltration, vacuum drying, freeze drying or oven drying, provided that the technique employed does not detrimentally alter the nutritional profile of the concentrated animal protein product. The invention is, therefore, in no way limited to a concentrated animal protein product produced using any particular water removal technique. Preferably, the removal of water from

the slurry is effected by falling film vacuum evaporation, centrifugation or turbo drying.

Prior to concentration of the slurry, an antioxidant may be added to the slurry. Preferably, the antioxidant is added in the form of a solution in a carrier such as soya oil.

Preferably, the concentrated animal protein product contains at least about 20% water by weight. More preferably, the concentrated animal protein product contains between about 40% and about 60% water by weight. Most preferably, the concentrated animal protein product contains between about 45% and about 55% water by weight.

In one embodiment of the invention, pre-ground raw meat is autolysed to produce a meat slurry which is then concentrated by removal of water by falling film vacuum evaporation. After the removal of water by falling film vacuum evaporation, the concentrated animal protein product may be partially defatted by centrifugation.

In an alternative embodiment of the invention, pre-ground raw meat is autolysed to produce a meat slurry which is then concentrated by removal of water and some oil by centrifugation.

According to the invention, it is possible to produce a concentrated animal protein product with high levels of any nutritional component occurring naturally in a proteinaceous animal material by appropriate selection of the animal protein starting materials, and thereby to tailor the nutritional profiles of foodstuffs incorporating concentrated animal protein products according to the invention to very specific diets. For example, according to invention it is possible to produce a concentrated animal protein product with high levels of chondroitin, to promote joint health, by selection of animal protein starting

materials rich in trachea, or to produce a concentrated animal protein product with high levels of Omega-3 fatty acids, by selection of animal protein starting materials rich in fish.

The level of incorporation of concentrated animal protein products according to the invention in extruded kibbles, and other foodstuffs, while maintaining an acceptable water content for the final foodstuff may be increased by further reduction in the water content and/or reduction in the fat content of the concentrated animal protein product and/or by combining incorporation of the concentrated animal protein product into the foodstuff by co-extrusion with incorporation by post-extrusion impregnation.

In addition, a reduction in the fat content of the concentrated animal protein product according to the invention improves the expansion properties of foodstuffs co-extruded with the concentrated animal protein product; an extrusion expanded kibble has been successfully made when a fat contribution of as much as 5% by weight of kibble is made by the concentrated animal protein product. Fat may be removed from the concentrated animal protein product in a number of ways, such as by centrifugation or the use of membranes, or may be removed from the slurry prior to concentration, for example by the addition of chemicals. If desired, the removed fat can be reintroduced into the foodstuff after it has been extruded, for example by coating or by impregnation using a vacuum coater.

Prior to concentration of the slurry, ingredients such as salts can be added to the slurry to facilitate the removal of water, for example by effecting pH and/or ionic changes.

The concentrated animal protein product of the invention can be incorporated into extruded dry and semi-moist pet foods and into extruded manufactured chunks by inclusion into the

pre-conditioner, co-extrusion by introduction with other ingredients to the barrel of the extruder, or by coating or impregnation of an extruded product subsequent to extrusion, or by any combination of these methods. Alternatively, the concentrated animal protein product of the invention can be incorporated into non-extruded dry and semi-moist pet foods and also manufactured chunks by inclusion into a mixer with other ingredients to produce a cereal dough or meat emulsion which can then be formed, heat set and dried.

The concentrated animal protein product of the present invention can be incorporated into wet pet foods by inclusion in the background meat mix, inclusion in a reformed meat ingredient, inclusion in manufactured chunks, inclusion in the gravy, or by any combination of these methods.

The invention will be understood in greater detail from the following examples of specific embodiments thereof:

Example 1

A concentrated animal protein product is made as follows:

A slurry is formed by autolysis of a pre-ground raw poultry mix; a conventional mixture of poultry heads, feet and viscera. The slurry is then concentrated to a water content of about 53% by weight by falling film vacuum evaporation. The nutritional profile of the concentrated animal protein product obtained is shown in Table 1, along with that of the raw poultry mix from which it was produced and the average nutritional profile of conventional poultry meals; the figures given in each column of Table 1 are the average of the values obtained from analyses of a number, n, of different samples. The figures shown in brackets for Example 1 are the values of the components in the concentrated animal protein product according to the

invention on an equal protein basis with the conventional poultry meal.

Example 2

An alternative concentrated animal protein product is made as follows:

A slurry is formed by autolysis of a pre-ground raw poultry mix containing 68% by weight of poultry liver and 29% by weight of the same poultry mix used in Example 1. The slurry is then concentrated to a water content of 60% by weight in the same way as in Example 1. The nutritional profile of the concentrated animal protein product obtained is shown in Table 1.

In Examples 1 and 2, 5.7% by weight of an antioxidant/soya oil solution was added to the slurry prior to concentration.

Little variation was found between the analysed nutritional profiles of the different samples of the concentrated animal protein product of Example 1, illustrating the consistent nutritional profiles of concentrated animal protein products provided according to the invention. In contrast, in the poultry meal samples analysed the levels of all vitamins as well as tryptophan, cystine, methionine, taurine and lineolic acid were found to be highly variable.

The in vitro pepsic digestibility, measured using the EC standard method, which gives an indication of the availability of the meat protein for digestion by an animal, of the concentrated animal protein products of Examples 1 and 2 are significantly higher than that of the conventional poultry meal; as previously discussed, the reduced digestibility of the protein in the meal is due to partial denaturing of the protein during the rendering process used to manufacture the meal.

TABLE 1

Raw Materials	Raw Poultry Mix	Example 1	Example 2	Poultry Meal
Proximates	n = 3	n = 5	n = 1	n = 11
% Moisture	67.7	53.1	60.0	4.7
% Protein	14.0	16.9	21.3	66.2
% Fat	13.4	22.8	12.2	12.5
% Ash	2.3	4.8	3.2	14.6
% CHO (by difference)	2.6	2.4	3.3	2.0
Dry Matter	(n = 3)	(n = 3)	(n = 1)	(n = 9)
Folic Acid(mg/kg)	1.45	1.2 (2.3)	8.4 (11.1)	1.96
Vit.B_{12}	0.30	0.26 (0.50)	0.33 (0.44)	0.16
Choline (mg/kg)		2.81 (5.41)	4.9	2.3
Biotin (mg/kg)		0.28 (0.54)	4.7	0.25
% in Protein				
% Tryptophan	1.1	1.0	-	0.47
% Histidine	2.0	2.1	2.5	2.0
% Arginine	6.1	6.4	6.3	7.9
% Threonine	3.7	3.8	4.1	3.5
% Alanine	6.7	6.2	5.8	6.2
% Cystine	1.1	1.1	1.3	1.2
% Tyrosine	2.9	3.2	3.8	2.8
% Valine	4.9	4.8	5.4	4.5
% Methionine	1.8	1.7	2.0	0.25
% Lysine	5.8	5.9	6.9	5.5
% Isoleucine	3.6	3.6	4.2	3.7
% Leucine	6.6	6.8	7.9	6.5
% Phenylalanine	3.9	4.0	4.5	3.7
% Taurine	0.8	0.77	0.61	0.21
% Pepsic Dig.	89.3	90.6	92.0	84.9

Raw Materials	Raw Poultry Mix	Example 1	Example 2	Poultry Meal
Per kg Fat				
Vit.A (IU)	<15.444 -36.200	26.383	390.164	76.982
Vit D_3 (IU)	-	-	-	2335
Vit.E (IU)	30.1	36.3	154.0	58.0
% in Fat				
Linoleic	21.0	29.2	24.3	15.3
Linolenic	2.0	3.5	2.3	1.8
Arachidonic	0.67	0.67	3.4	0.73

Inclusion of 68% poultry liver in the animal protein starting mixture in Example 2, significantly increases the protein to fat ratio in the concentrated animal protein product obtained and also increases the levels of all vitamins except B12. This illustrates that the nutritional profile of the concentrated animal protein product of the invention can be tailored by selection of the animal protein starting materials.

Example 3

An extruded kibble containing the concentrated animal protein product of Example 1 was made by co-extrusion of the kibble with between about 30% to about 40% by weight of the concentrated animal protein product. The nutritional profile, on a dry matter basis, of the extruded kibble obtained is shown in Table 2, along with that of a "control" kibble co-extruded with between about 9 to about 17% by weight poultry meal; poultry fat was added to the control kibble recipe to give a kibble fat content comparable to that of the kibble of Example 3. The basic kibble recipe employed for the control kibble and Examples 3 to 5 contained equal proportions of maize, wheat and rice flours and no mineral or vitamin supplements.

TABLE 2

Extruded Kibbles	+9.0-16.5% Poultry Meal	Example 3	Example 4	Example 5
Dry Matter	(n = 8)	(n = 6)	(n = 5)	(n = 1)
% Protein	22.1	17.0	17.0	23.4
% Fat	11.5	13.9	12.4	9.0
% Ash	3.5	3.7	3.3	2.6
% Ca	0.67	0.43	0.41	0.19
% P	0.62	0.45	0.41	0.45
% Mg	0.09	0.085	0.08	0.08
Mn (mg/kg)	15.6	17.0	16.4	15.9
% K	0.33	0.40	0.34	0.38
% Na	0.14	0.58	0.51	0.35
Fe (mg/kg)	76.3	67.8	55.6	87.0
Cu (mg/kg)	6.0	10.4	6.7	5.7
Zn (mg/kg)	53.4	40.7	34.0	41.8
I (mg/kg)	4.9	3.7	4.4	-
Vit B_1 (mg/kg)	6.1	10.9	42.3	3.5
Vit B_2 (mg/kg)	5.9	9.8	23.4	10.4
Pantothenic Acid (mg/kg)	13.8	19.0	20.9	37.8
Niacin (mg/kg)	24.0	38.5	33.8	63.5
Vit B_6 (mg/kg)	2.2	2.8	3.3	2.6
Folic Acid (mg/kg)	1.1	1.6	1.3	3.0
Vit.B_{12} (mg/kg)	-	-	-	-
Choline (mg/g)	0.058	0.11	0.13	0.11
Biotin (mg/kg)	1.1	-	-	1.70
	0.3	-	-	0.75

Extruded Kibbles	+9.0-16.5% Poultry Meal	Example 3	Example 4	Example 5
% in Protein				
% Tryptophan	1.0	0.97	0.95	1.25
% Histidine	2.4	2.3	2.4	2.70
% Arginine	6.5	6.4	6.3	7.3
% Threonine	3.5	3.4	3.4	3.7
% Alanine	5.4	5.6	5.4	4.8
% Cystine	0.68	0.82	0.77	0.60
% Tyrosine	3.3	3.3	3.3	3.8
% Valine	4.6	4.7	4.7	4.7
% Methionine	0.8	0.76	0.63	0.46
% Lysine	4.5	4.3	4.0	4.0
% Isoleucine	3.8	3.7	3.6	3.7
% Leucine	8.0	8.2	8.2	7.8
% Phenylalanine	4.5	4.5	4.5	5.3
% Taurine	0.28	0.48	0.54	0.33
Per kg Fat				
Vit.A (IU)	161.858	37.142	28.265	738.554
Vit.D_3 (IU)	-	1180	-	-
Vit.E (IU	447	495	209	106
% in Fat				
Linoleic	29.4	28.4	28.4	27.8
Linolenic	3.0	3.4	3.4	2.1
Arachidonic	0.33	0.41	0.41	2.0

Example 4

An extruded kibble containing the concentrated animal protein product of Example 1 was made by sequential impregnation of the extruded kibble with the concentrated animal protein product using a vacuum coater. The as-extruded kibble, with a moisture content of about 20% water by weight, was first

impregnated with about 20% by weight of the concentrated animal protein product, then dried to a moisture content of about 20% water by weight, before a second impregnation with about 12% by weight of the concentrated animal protein product. The nutritional profile of the extruded kibble obtained is shown in Table 2.

Example 5

An extruded kibble containing the concentrated animal protein product of Example 2 was made by co-extrusion of the kibble with about 40% by weight of the concentrated animal protein product. The nutritional profile of the extruded kibble obtained is shown in Table 2.

As can be seen in Table 2, up to about 40% of the concentrated animal protein products of Examples 1 and 2 can be satisfactorily incorporated into the extruded kibbles, either by co-extrusion or by sequential, post-extrusion, impregnation using a vacuum coater.

Extruded kibbles produced by co-extrusion with the concentrated animal protein product of Example 2, produced from a raw mix containing a high proportion of poultry liver, have increased protein to fat ratios and also significantly increased levels of most vitamins. This illustrates that the nutritional profile of a foodstuff into which a concentrated animal protein product according to the invention is incorporated can be successfully tailored by selection of the animal protein starting materials from which the concentrated animal protein product is produced. It will be appreciated that the tailoring of the nutritional profile of a foodstuff by incorporation of a concentrated animal protein product according to the invention is not limited to variation of the content in the foodstuff of those nutrients listed in Tables 1 and 2.

TABLE 3

Raw Material	ROM Analysis (%)			Co-Extruded Level (%)	Contribution to Extrudate (%)			Poultry Meal Equivalent (%) (Equal Protein)
	H_2O	Protein	Fat		H_2O	Protein	Fat	
Poultry Meal	4.7	66.2	12.5	10.0	-	6.6	1.25	10.0
				20.0	-	13.2	2.50	20.0
				30.0	-	19.9	3.75	30.0
Example 1	56.2	18.7	18.1	40.0	22.6	7.5	7.2	11.3
Example 1: 45% water	45.0	23.5	22.7	50.0	22.5	11.8	11.4	17.8
Example 1: 45% water; fat content reduced by 50%	50.8	26.5	12.8	44.5	22.6	11.8	5.7	17.8
Example 1: 45% water; fat content reduced by 75%	54.2	28.3	6.9	41.5	22.5	11.7	2.9	17.7
Example 2	60.0	21.3	12.2	40.0	24.0	8.5	4.9	12.8
Example 2: 50% water	50.0	26.6	15.3	48.0	24.0	12.8	7.3	19.3
Example 2: 50% water; fat content reduced by 50%	54.1	28.8	8.3	44.4	24.0	12.8	3.7	19.3

The effect of water removal, and water and fat removal, on the water, protein and fat contents of the concentrated animal protein products of Examples 1 and 2 is shown in Table 3, along with the water, protein and fat contents of extruded kibbles co-extruded with the concentrated animal protein products.

The concentrated animal protein product of the invention has been found to have an improved nutritional performance compared to conventional meat meals. The concentrated animal protein product of the invention can be manufactured using a wide range of mixes of raw meat and other animal protein starting materials, including mixes unsuitable for the manufacture of conventional meat meals. Use of the concentrated animal protein product of the invention as a protein source enables the manufacture of foodstuffs with high protein content, acceptable fat levels and predictable and reliable targeted nutritional profiles. By selection of appropriate animal protein starting materials, use of the concentrated animal protein product of the invention as a protein source, reduces or eliminates the need for the addition of vitamin, fat, oil or other nutritional supplements in order to produce satisfactory foodstuffs.

CLAIMS

1. A method of providing a concentrated animal protein product for use as a protein source in foodstuffs, comprising hydrolysing the animal protein to form a slurry and removing water from the slurry.

2. A method according to claim 1 wherein the animal protein is raw meat.

3. A method according to claim 2 wherein the meat is pre-ground.

4. A method according to claim 1, 2 or 3 wherein the hydrolysis is enzymatic hydrolysis.

5. A method according to any preceding claim wherein the hydrolysis is autolysis.

6. A method according to any preceding claim further comprising effecting chemical changes to facilitate the removal of water and/or fat from the slurry.

7. A method according to any preceding claim further comprising addition of an antioxidant to the slurry prior to water removal.

8. A method according to any preceding claim wherein the water is removed by turbo drying or falling film vacuum evaporation.

9. A method according to any preceding claim further comprising the removal of fat from the concentrated animal

protein product prior to inclusion of the product in a foodstuff.

10. A method according to claim 9 further comprising the subsequent addition of fat to the foodstuff.

11. A concentrated animal protein product produced by a method according to any of claims 1 to 10.

12. A concentrated animal protein product according to claim 11 containing at least 20% water by weight.

13. A concentrated animal protein product according to claim 11 or 12 containing between 40% and 60% water by weight.

14. A concentrated animal protein product according to claim 11, 12 or 13 containing between 45% and 55% water by weight.

15. A concentrated animal protein product characterised in that it contains between 45% and 55% water by weight.

16. A foodstuff incorporating a concentrated animal protein product according to any of claims 11 to 15.

17. A pet foodstuff according to claim 16.

18. A method of controlling the nutritional content of a foodstuff comprising:

selecting a desired level of each of a plurality of components of the food stuff;

providing a concentrated animal protein product by a method according to any of claims 1 to 9 having levels of the said components such that when the said product is incorporated in the foodstuff the said components are in

the foodstuff at the desired level of each component in the foodstuff; and

incorporating the said product in the foodstuff.

19. A method for producing a concentrated animal protein product substantially as described.

20. A concentrated animal protein product substantially as described.

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 02/00685

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23J1/02 A23J3/34 A23K1/10 A23K1/16 A23K1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23J A23K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, FSTA, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 030 649 A (FREEMAN LEON D ET AL) 29 February 2000 (2000-02-29) column 2, line 14-25 claims 1,2,7,13	1,4,7,9, 11-16, 18-20
X	US 4 054 674 A (BARKER DAVID ET AL) 18 October 1977 (1977-10-18) column 1, line 52 -column 2, line 14 claim 1; examples 4,6	1-3,5,7, 9-20
X	US 5 607 840 A (SCHUBERT II ROBERT L ET AL) 4 March 1997 (1997-03-04) claim 1	1-4,11, 16,18-20

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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21 May 2002	10/06/2002

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INTERNATIONAL SEARCH REPORT

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PCT/GB 02/00685

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 280 415 A (MCLEAN KIRK WILLIAM ;GORDON JOHN JAMES (GB)) 31 August 1988 (1988-08-31) page 2, line 5-10 page 5, line 24-36 page 5, line 57 -page 6, line 3 page 6, line 38-41 claim 1	1-4,6,9, 11,16, 18-20
X	US 4 016 295 A (BURROWS IAN EDWARD ET AL) 5 April 1977 (1977-04-05) column 1, line 33-40 column 2, line 3-23 claims 1,7; examples 1,4	1-7, 11-20
X	US 4 262 022 A (HALD-CHRISTENSEN VILHELM ET AL) 14 April 1981 (1981-04-14) column 1, paragraph 1 column 6, paragraph 2; claim 1	1,4,8, 11-13, 16,18-20
X	US 6 174 551 B1 (WEDDINGTON EUGENE M ET AL) 16 January 2001 (2001-01-16) claims 1,2	1,4,11, 16-20
X	DATABASE WPI Section Ch, Week 198520 Derwent Publications Ltd., London, GB; Class C03, AN 1985-118620 XP002176269 & JP 60 058043 A (MITSUI TOATSU CHEM INC), 4 April 1985 (1985-04-04) abstract	1,2,4,9, 16,18-20

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 02/00685

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 6030649	A	29-02-2000	NONE		
US 4054674	A	18-10-1977	GB	1467432 A	16-03-1977
			AT	339718 B	10-11-1977
			AT	342274 A	15-02-1977
			AU	6811874 A	23-10-1975
			BE	814063 A1	16-08-1974
			CH	593622 A5	15-12-1977
			DE	2419720 A1	07-11-1974
			DK	146031 B	06-06-1983
			ES	425549 A1	16-06-1976
			FR	2226935 A1	22-11-1974
			IE	39366 B1	27-09-1978
			IT	1019600 B	30-11-1977
			JP	1192857 C	29-02-1984
			JP	50051867 A	08-05-1975
			JP	58025417 B	27-05-1983
			LU	69935 A1	06-08-1974
			NL	7405622 A ,B,	29-10-1974
			NO	138320 B	08-05-1978
			SE	399809 B	06-03-1978
US 5607840	A	04-03-1997	AU	5681094 A	22-06-1994
			WO	9412524 A1	09-06-1994
EP 0280415	A	31-08-1988	AU	1180088 A	24-08-1988
			EP	0280415 A1	31-08-1988
			WO	8805633 A1	11-08-1988
			PT	86678 A ,B	01-03-1988
US 4016295	A	05-04-1977	GB	1484264 A	01-09-1977
			AT	350369 B	25-05-1979
			AT	191877 A	15-10-1978
			AT	342965 B	10-05-1978
			AT	819974 A	15-08-1977
			AU	7443174 A	29-04-1976
			BE	821211 A1	17-02-1975
			CA	1043152 A1	28-11-1978
			CH	612328 A5	31-07-1979
			DE	2449160 A1	24-04-1975
			DK	541774 A ,B,	16-06-1975
			ES	431132 A1	01-11-1976
			FR	2247983 A1	16-05-1975
			IE	40530 B1	20-06-1979
			IT	1030705 B	10-04-1979
			JP	1133688 C	27-01-1983
			JP	50070542 A	12-06-1975
			JP	57021966 B	11-05-1982
			LU	71114 A1	17-04-1975
			NL	7413733 A ,C	22-04-1975
			NO	743645 A ,B,	12-05-1975
			SE	418567 B	15-06-1981
			SE	7413095 A	21-04-1975
US 4262022	A	14-04-1981	AU	518741 B2	15-10-1981
			AU	4396479 A	16-08-1979
			BE	873932 A1	06-08-1979
			DE	2904239 A1	09-08-1979

INTERNATIONAL SEARCH REPORT

Int ›nal Application No
PCT/GB 02/00685

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4262022 A		DK 46579 A	01-03-1979
		FR 2415968 A1	31-08-1979
		GB 2018121 A ,B	17-10-1979
		NL 7900908 A	08-08-1979
US 6174551 B1	16-01-2001	EP 0981282 A1	01-03-2000
		JP 2001514499 T	11-09-2001
JP 60058043 A	04-04-1985	NONE	

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